ANOVA F test

analysis of variance

1 Calculate mean of each population :-

$m_1 = \frac{1}{3}(1+2+5) = 2.67$

$m_2 = \frac{1}{3}(2+4+2) = 2.67$

$m_3 = \frac{1}{3}(2+3+4) = 3$

} equal by chance

data sets

D_1	D_2	D_3
1	2	2
2	4	3
5	2	4

K → number of populations

K = 3

calculate grand mean m_0 :-

$m_0 = \frac{1}{3}(2.67 + 2.67 + 3) = 2.78$

2 calculate sum of Squares (SS) :-

$$SS_{withIN} = \sum_i (x_{1i} - m_1)^2 + \sum_i (x_{2i} - m_2)^2 + \sum_i (x_{3i} - m_3)^2$$

$$= \left[(1-2.67)^2 + (2-2.67)^2 + (5-2.67)^2 \right] + \left[(2-2.67)^2 + (4-2.67)^2 + (2-2.67)^2 \right] + \left[(2-3)^2 + (3-3)^2 + (4-3)^2 \right] = 13.34$$

$$SS_{Total} = \sum (x - m_0)^2$$

$$= (1-2.78)^2 + (2-2.78)^2 + (5-2.78)^2 + (2-2.78)^2 + (4-2.78)^2 + (2-2.78)^2 + (2-2.78)^2 + (3-2.78)^2 + (4-2.78)^2 = 13.6$$

$$SS_{between} = SS_{Total} - SS_{withIN} = 13.6 - 13.34 = 0.23$$

N : total number of sample $= 3+3+3 = 9$, $K = 3$

$$S_W^2 = \frac{SS_{WithIN}}{N-K} = \frac{13.34}{9-3} = 2.22$$

$$S_B^2 = \frac{SS_{Between}}{K-1} = \frac{0.23}{3-1} = 0.115$$

$$F = \frac{S_B^2}{S_W^2} = 0.05$$

if $F > 1$, then difference between hypothesis is big then reject Null hypothesis

if $F < 1$, then difference is small and not reject Null hypothesis.